Title: Pipeline Scheduler With Fairness and Minimum Bandwidth Guarantee
Inventor: FAN, Ruixue et al.
U.S. Appln. No. Unknown
Attorney Docket No. A7914

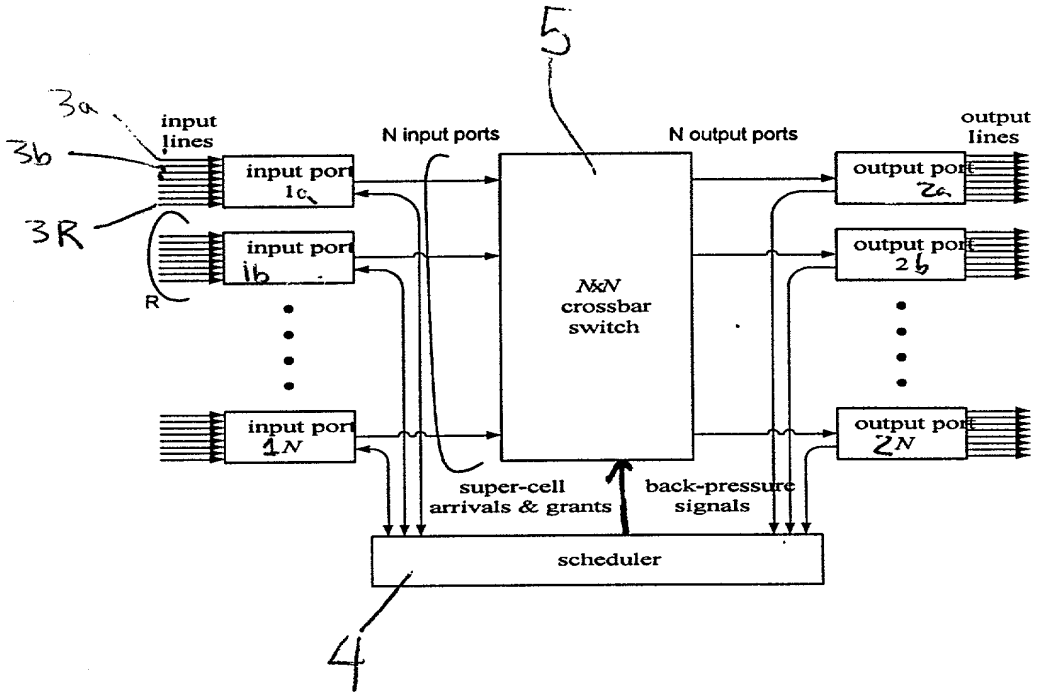

FIGURE 1

parameter	meaning	typical value
N	number of input and output ports	64
L	number of input and output lines	512
R	number of lines per port	8
K	number of classes	8
M	number of scheduling modules	16
S	number of pipeline stages per scheduling module	1
C	number of cells per super-cell	8

FIGURE 2

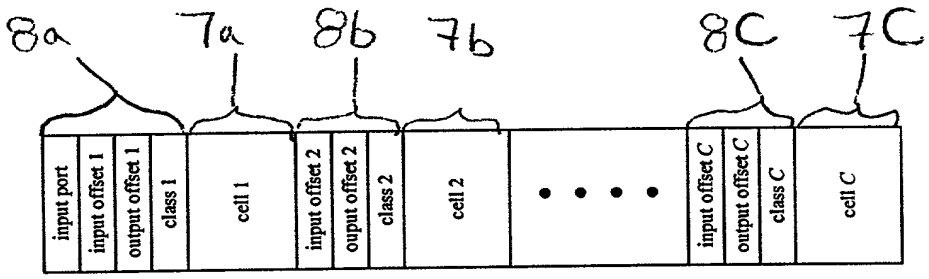
8a
7a
8b
7b
8C
7C
input port
input offset 1
output offset 1
class 1
cell 1
input offset 2
ouput offset 2
class 2
cell 2
input offset C
output offset C
class C
cell C

FIGURE 3

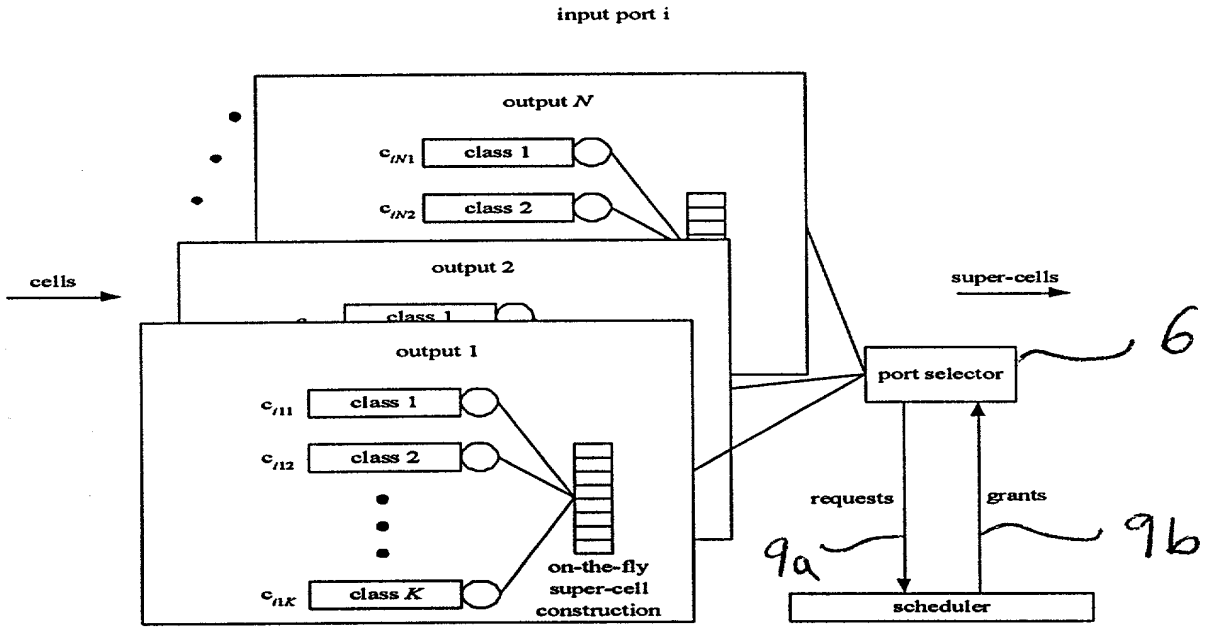
input port i
output N
c_{iN1}
class 1
c_{iN2}
class 2
output 2
class 1
output 1
c_{i1}
class 1
c_{i2}
class 2
c_{iK}
class K
on-the-fly
super-cell
construction
cells
super-cells
port selector
6
requests
grants
9a
9b
scheduler

FIGURE 4

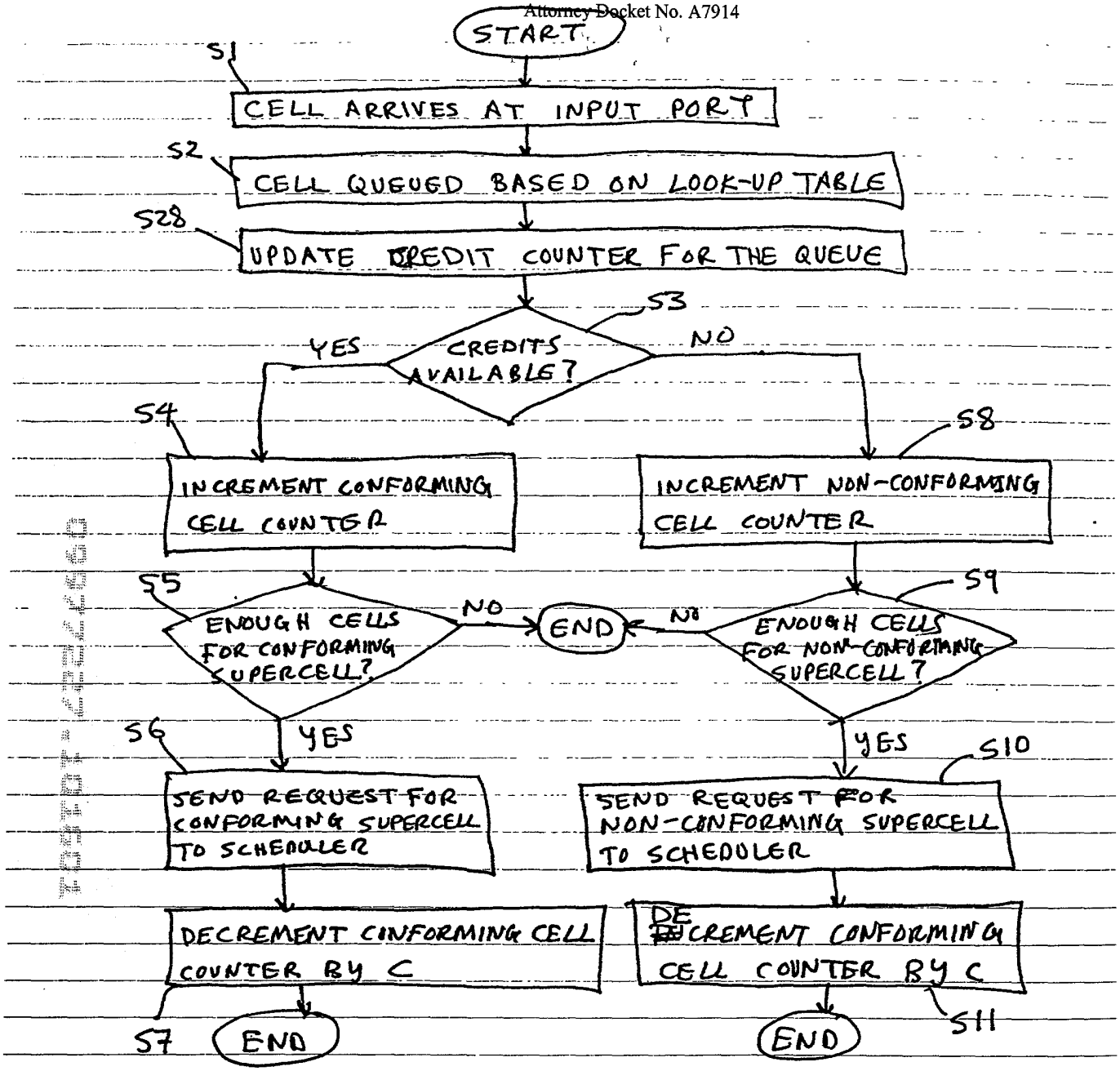
START
S1
CELL ARRIVES AT INPUT PORT
S2
CELL QUEUED BASED ON LOOK-UP TABLE
S28
UPDATE CREDIT COUNTER FOR THE QUEUE
S3
CREDITS AVAILABLE?
YES
NO
S4
INCREMENT CONFORMING CELL COUNTER
S8
INCREMENT NON-CONFORMING CELL COUNTER
S5
ENOUGH CELLS FOR CONFORMING SUPERCELL?
NO
END
NO
S9
ENOUGH CELLS FOR NON-CONFORMING SUPERCELL?
S6
YES
YES
S10
SEND REQUEST FOR CONFORMING SUPERCELL TO SCHEDULER
SEND REQUEST FOR NON-CONFORMING SUPERCELL TO SCHEDULER
DECREMENT CONFORMING CELL COUNTER BY C
DECREMENT CONFORMING CELL COUNTER BY C
S7
END
END
S11

FIGURE 5(a)

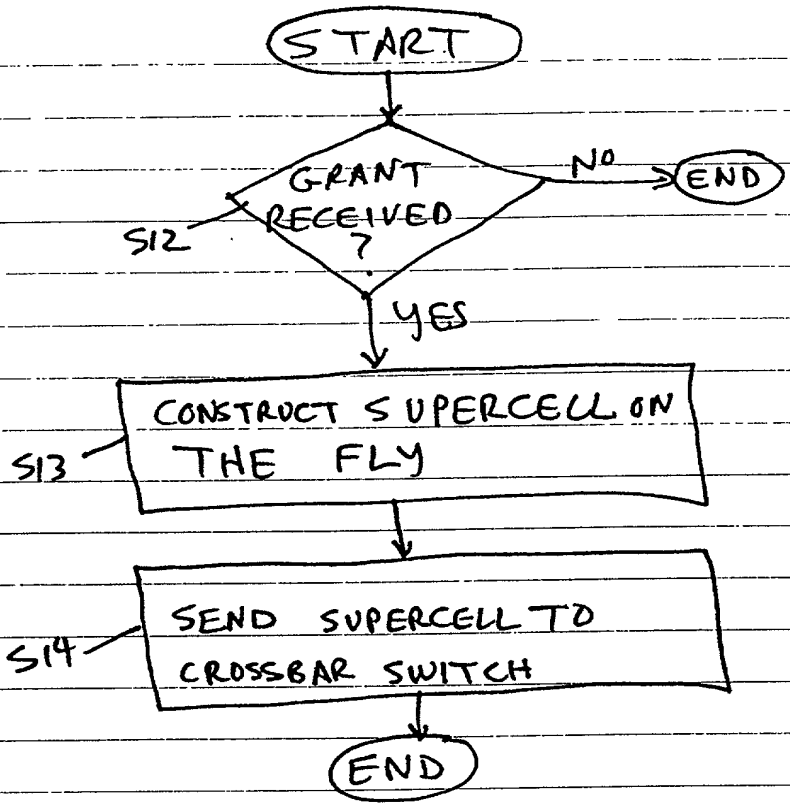
START
GRANT RECEIVED ?
S12
NO
END
YES
CONSTRUCT SUPERCELL ON THE FLY
S13
SEND SUPERCELL TO CROSSBAR SWITCH
S14
END

FIGURE 5(b)

Title: Pipeline Scheduler With Fairness and Minimum Bandwidth Guarantee
Inventor: FAN, Ruixue et al.
U.S. Appln. No. Unknown
Attorney Docket No. A7914

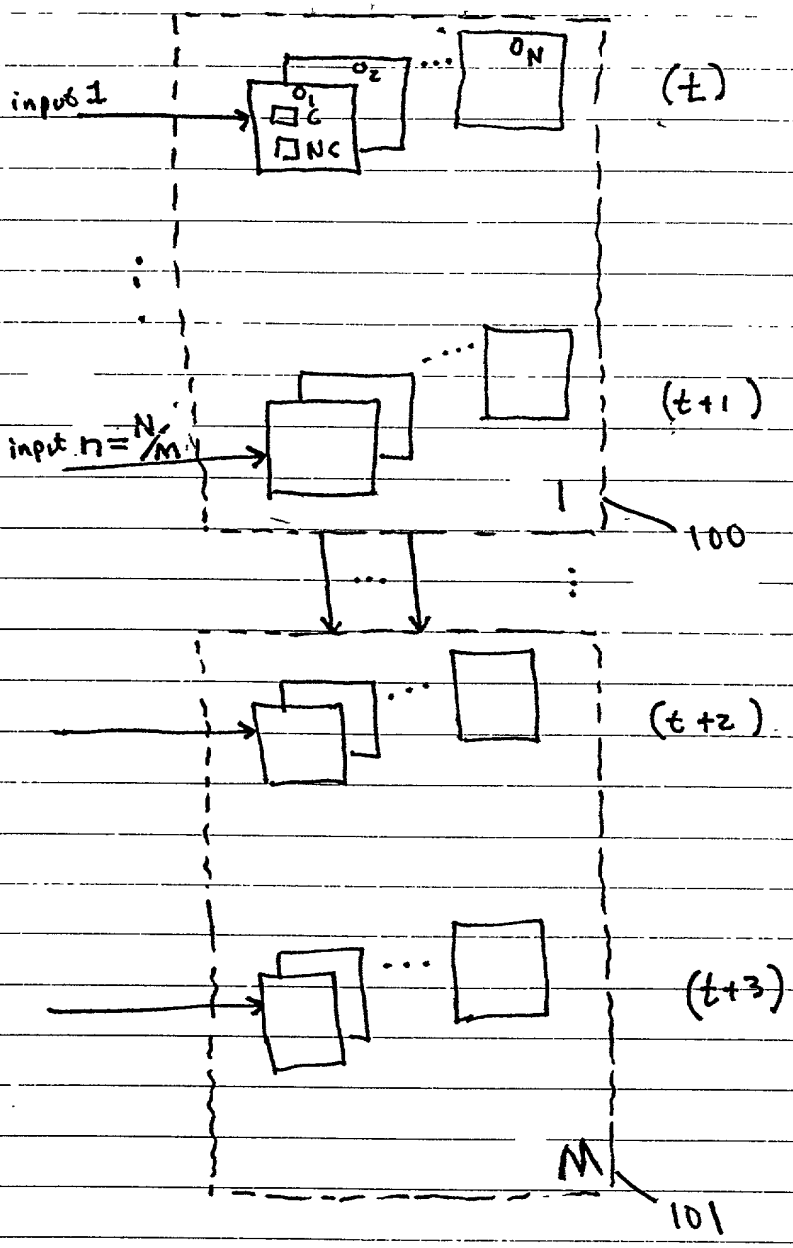

FIGURE 6

Title: Pipeline Scheduler With Fairness and Minimum Bandwidth Guarantee
Inventor: FAN, Ruixue et al.
U.S. Appln. No. Unknown
Attorney Docket No. A7914

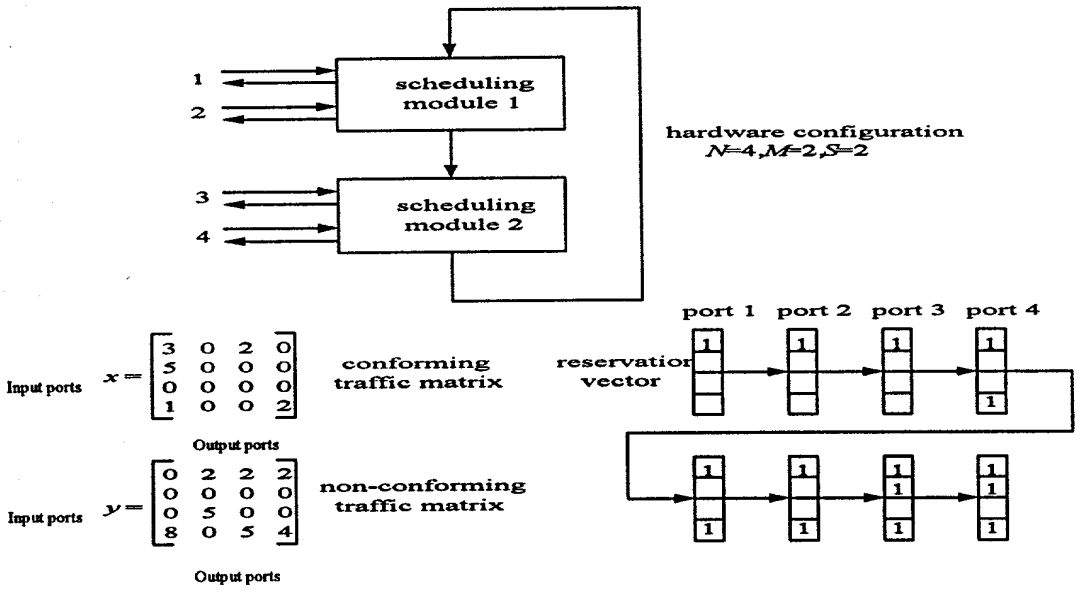

FIGURE 7

Title: Pipeline Scheduler With Fairness and Minimum Bandwidth Guarantee
Inventor: FAN, Ruixue et al.
U.S. Appln. No. Unknown
Attorney Docket No. A7914

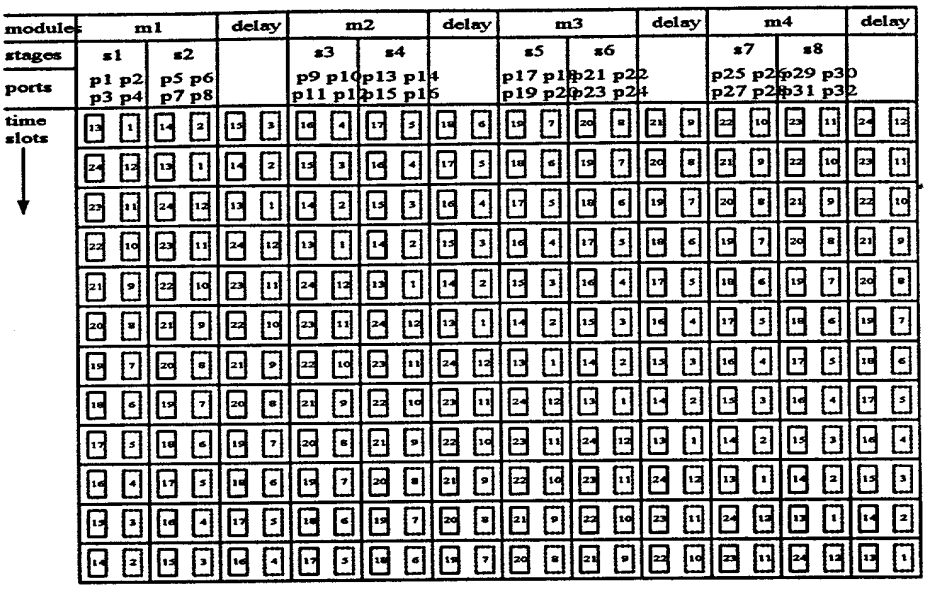

FIGURE 8

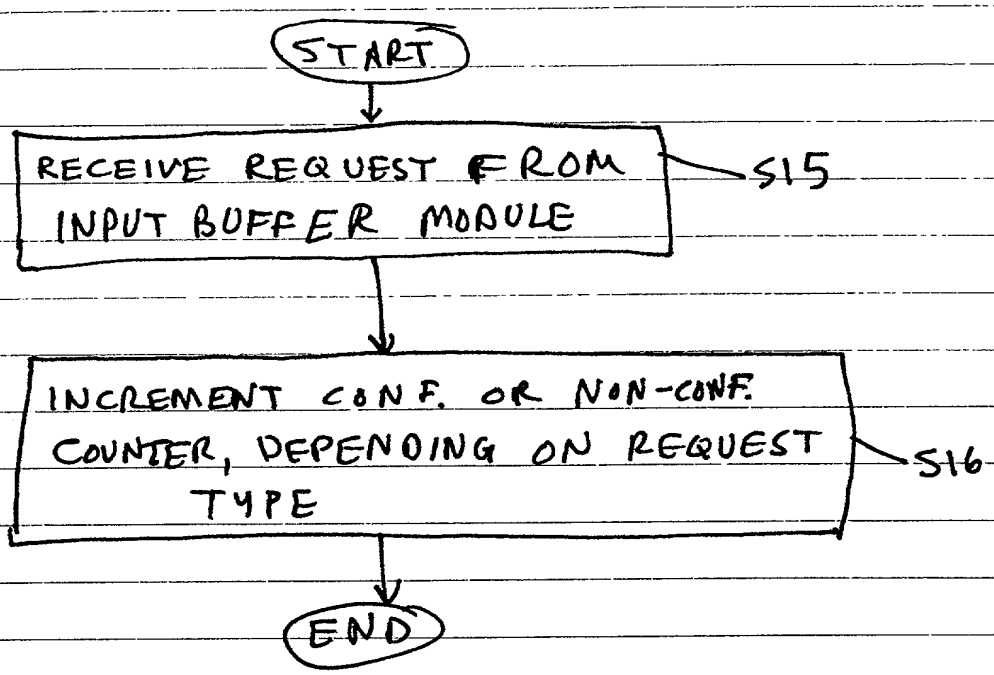

FIGURE 9

ATTORNEY DOCKET

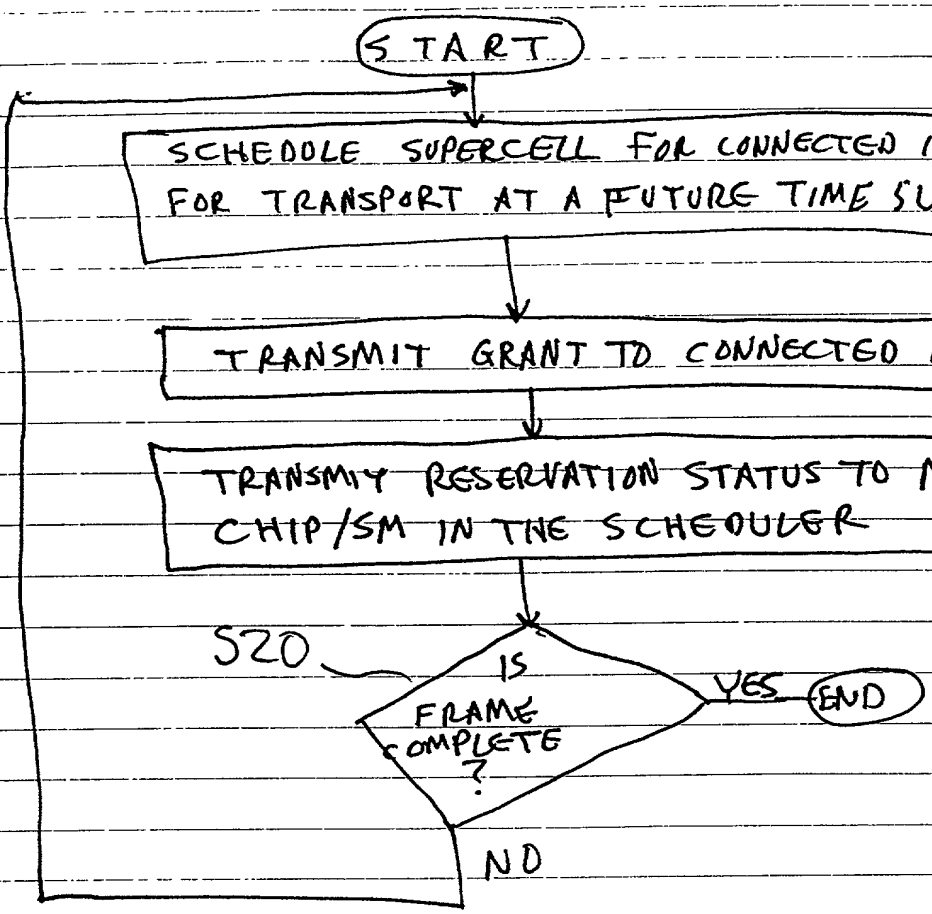
START
SCHEDULE SUPERCELL FOR CONNECTED INPUT, FOR TRANSPORT AT A FUTURE TIME SLOT
S17
TRANSMIT GRANT TO CONNECTED INPUT
S18
TRANSMIT RESERVATION STATUS TO NEXT CHIP/SM IN THE SCHEDULER
S19
S20
IS FRAME COMPLETE ?
YES
END
NO

FIGURE 10

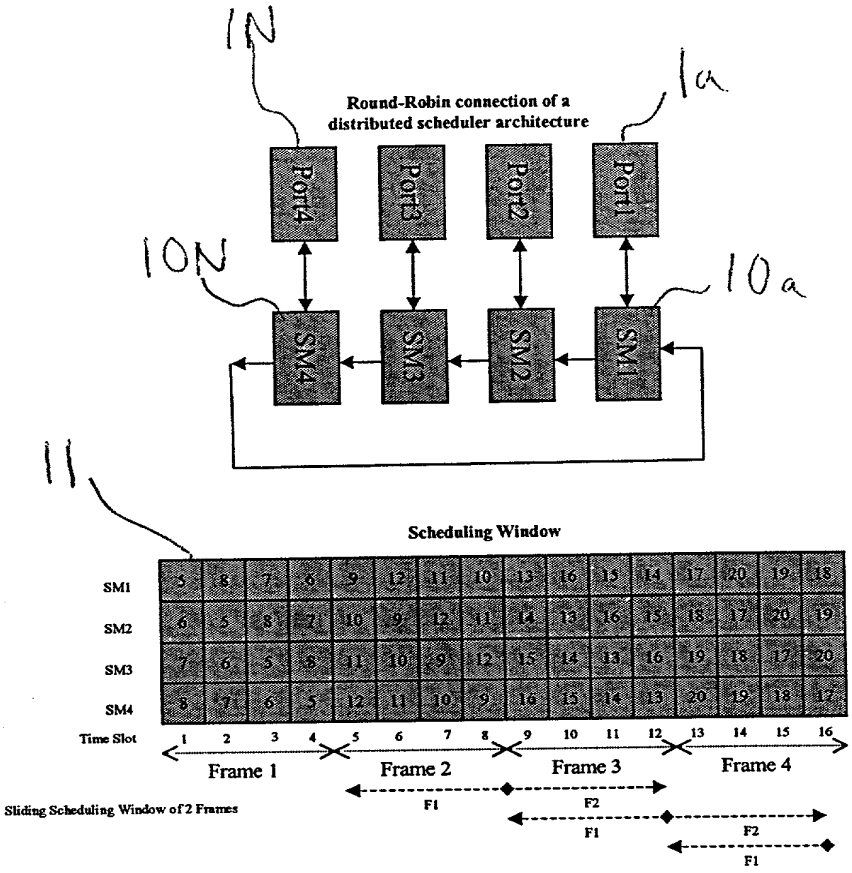
1N
1a
Round-Robin connection of a distributed scheduler architecture
Port4
Port3
Port2
Port1
10N
10a
SM4
SM3
SM2
SM1
11
Scheduling Window
SM1
SM2
SM3
SM4
Time Slot
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Frame 1
Frame 2
Frame 3
Frame 4
Sliding Scheduling Window of 2 Frames
F1
F2
F1
F2
F1

FIGURE . 11

Title: Pipeline Scheduler With Fairness and Minimum Bandwidth Guarantee
Inventor: FAN, Ruixue et al.
U.S. Appln. No. Unknown
Attorney Docket No. A7914

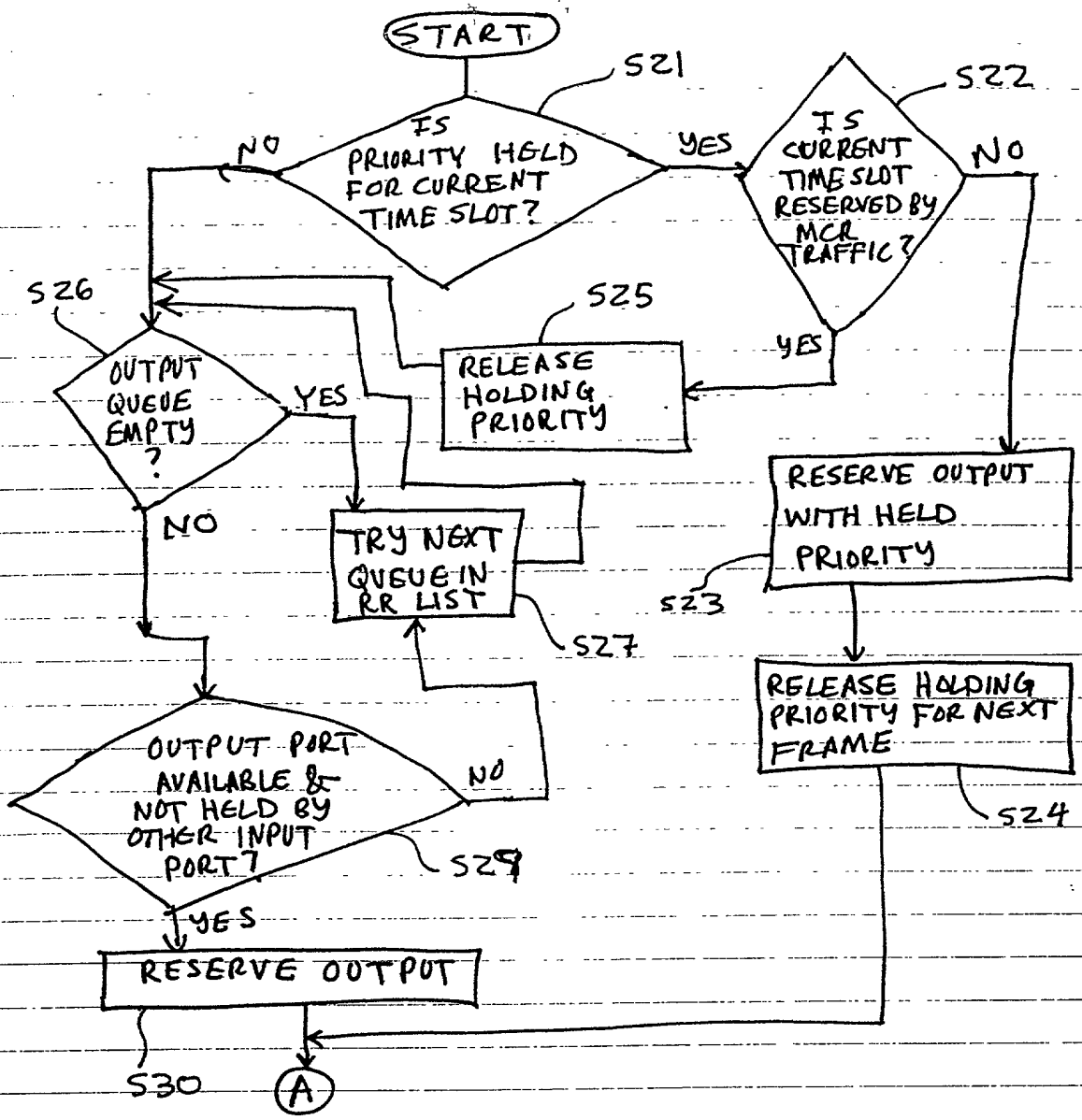

FIGURE 12(a)

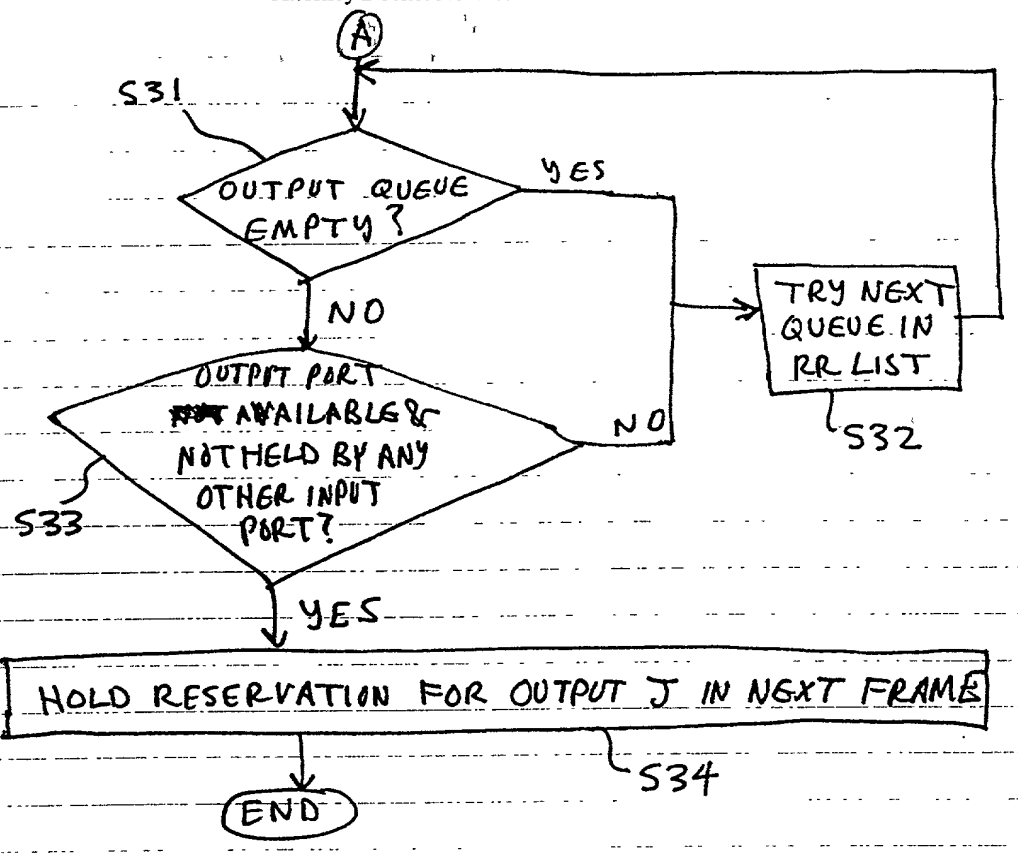
A
S31
OUTPUT QUEUE EMPTY?
YES
NO
TRY NEXT QUEUE IN RR LIST
S32
OUTPUT PORT AVAILABLE & NOT HELD BY ANY OTHER INPUT PORT?
NO
S33
YES
HOLD RESERVATION FOR OUTPUT J IN NEXT FRAME
S34
END

FIGURE 12(b)

Title: Pipeline Scheduler With Fairness and Minimum Bandwidth Guarantee
Inventor: FAN, Ruixue et al.
U.S. Appln. No. Unknown
Attorney Docket No. A7914

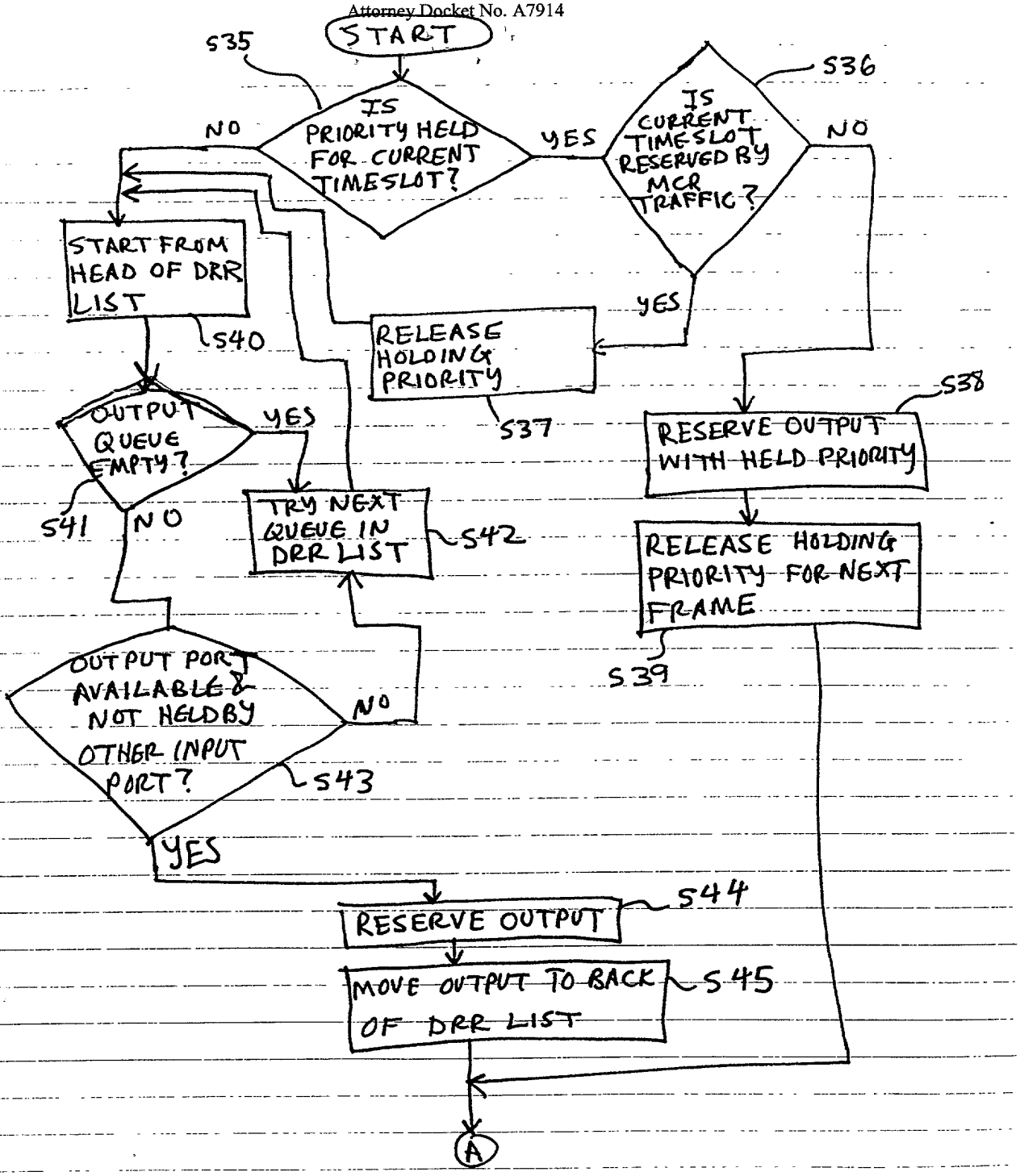

FIGURE 13(a)

Title: Pipeline Scheduler With Fairness and Minimum Bandwidth Guarantee
Inventor: FAN, Ruixue et al.
U.S. Appln. No. Unknown
Attorney Docket No. A7914

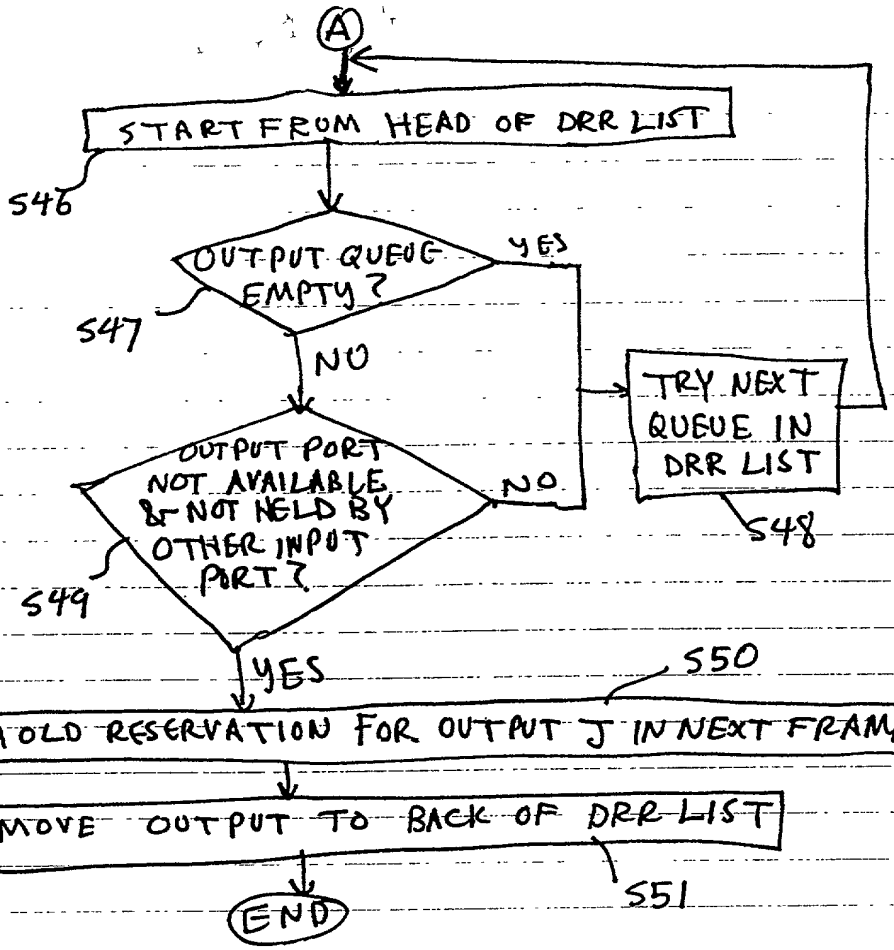

FIGURE 13 (b)

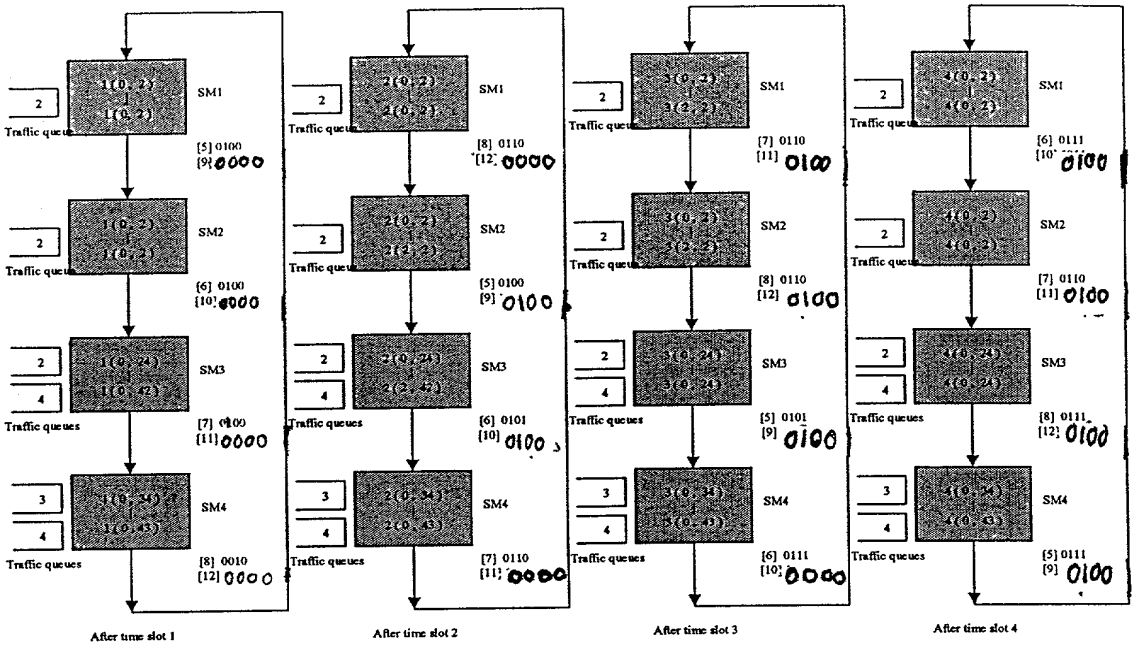
SM1
SM2
SM3
SM4
Traffic queues
After time slot 1
After time slot 2
After time slot 3
After time slot 4

FIGURE 14(a)

Title: Pipeline Scheduler With Fairness and Minimum Bandwidth Guarantee
Inventor: FAN, Ruixue et al.
U.S. Appln. No. Unknown
Attorney Docket No. A7914

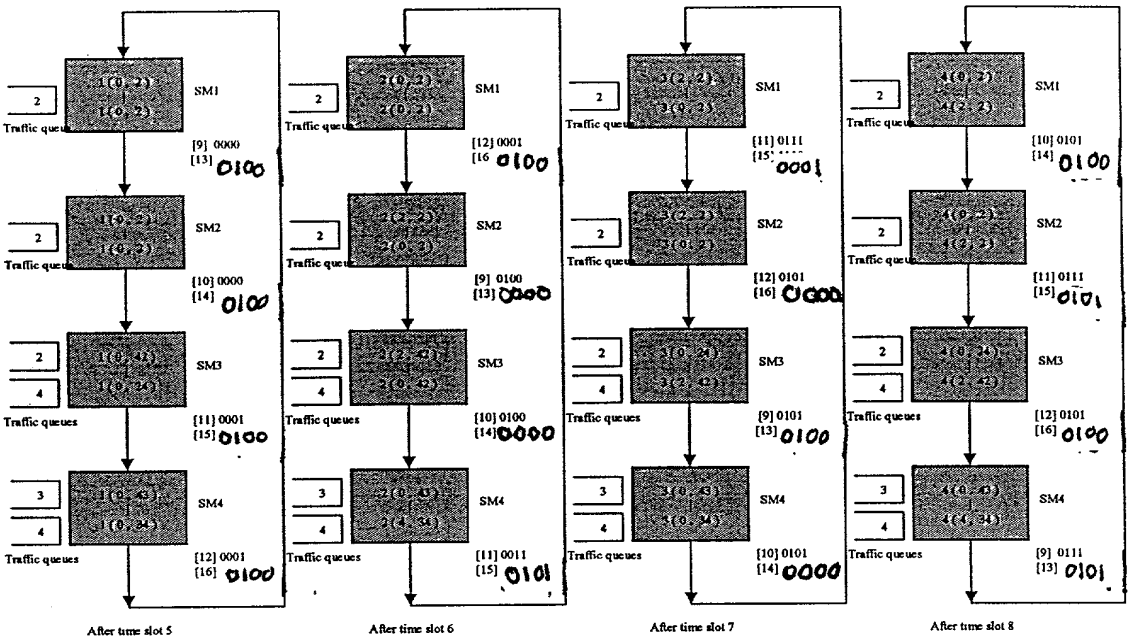

FIGURE 14(b)

Title: Pipeline Scheduler With Fairness and Minimum Bandwidth Guarantee
Inventor: FAN, Ruixue et al.
U.S. Appln. No. Unknown
Attorney Docket No. A7914

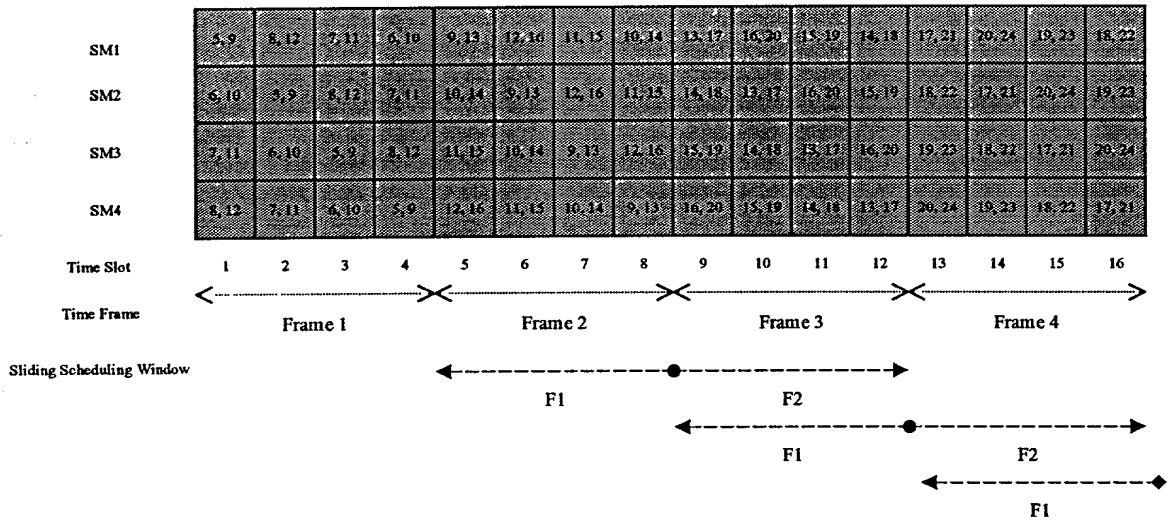

FIGURE 15

Title: Pipeline Scheduler With Fairness and Minimum Bandwidth Guarantee
Inventor: FAN, Ruixue et al.
U.S. Appln. No. Unknown
Attorney Docket No. A7914

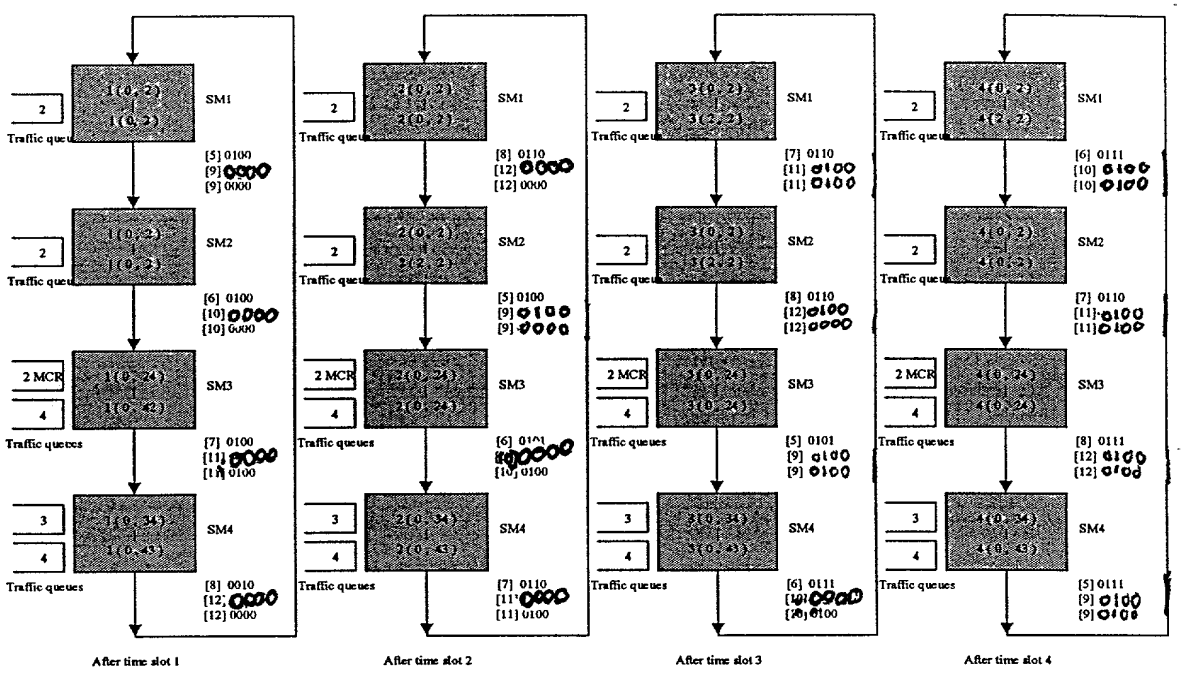

FIGURE 16

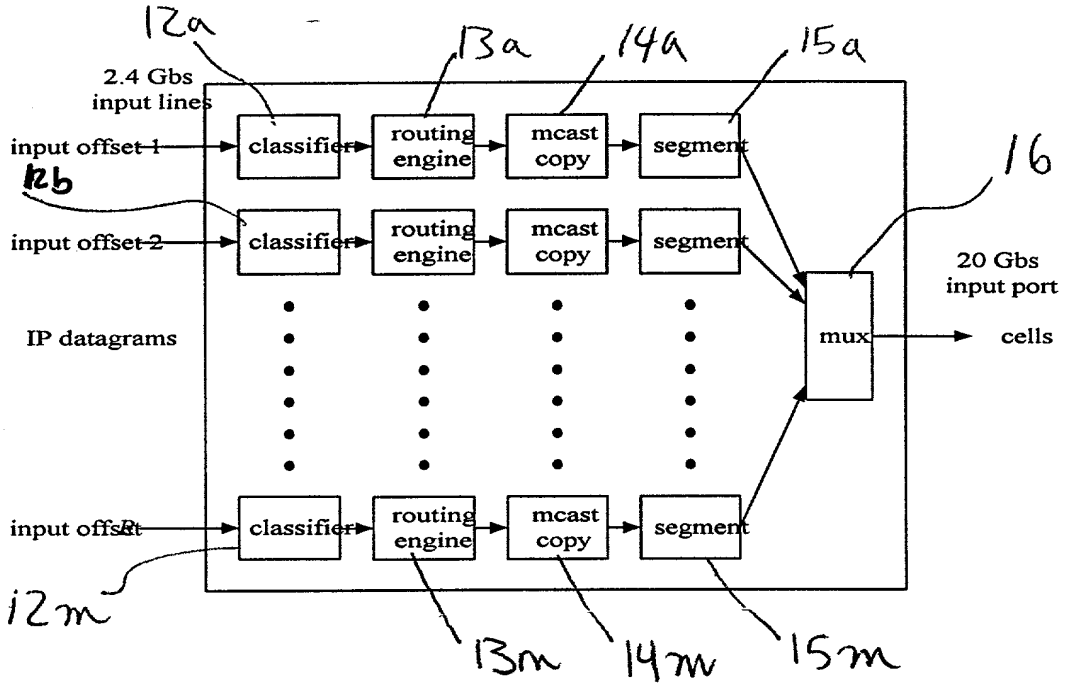
12a
13a
14a
15a
2.4 Gbs
input lines
input offset 1
12b
input offset 2
IP datagrams
input offset n
12m
classifier
routing engine
mcast copy
segment
16
mux
20 Gbs
input port
cells
13m
14m
15m

FIGURE 17

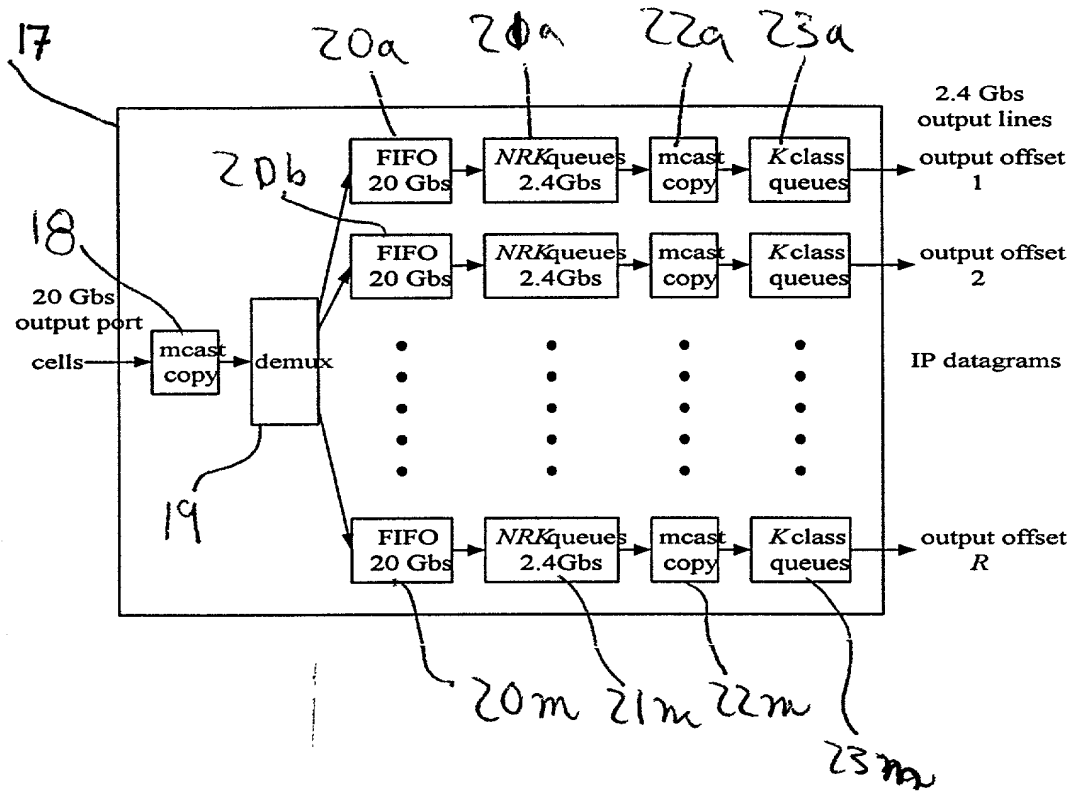
17
20a
20
22a
23a
2.4 Gbs
output lines
20b
FIFO
20 Gbs
NRKqueues
2.4Gbs
mcast
copy
Kclass
queues
output offset
1
18
FIFO
20 Gbs
NRKqueues
2.4Gbs
mcast
copy
Kclass
queues
output offset
2
20 Gbs
output port
cells
mcast
copy
demux
IP datagrams
19
FIFO
20 Gbs
NRKqueues
2.4Gbs
mcast
copy
Kclass
queues
output offset
R
20m
21m
22m
23m

FIGURE 18